MODELS OF THE INTRA-REGIONAL TRADE INFLUENCE ON ECONOMIC SUSTAINABLE DEVELOPMENT IN ROMANIA

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Abstract
This paper estimates the impact of trade between Romania and EU (export and imports) on sustainable development (defined through the following ratios: GDP growth and employment level) using dynamic forecasting and vector auto-regression (VAR) methods. Logistic regression forecasts the evolution of the GDP based on the evolution of exports and imports in the light of the Lisbon agenda, and the time horizon of 2010. Using data regarding intra-regional trade, the model may predict the GDP evolution, and, consequently, the economic sustainable development in Romania, as a new member of European Union.

Key words: sustainable development intra-regional trade, economic integration, regression, model

JEL Classification: C25, F15, Q56

Introduction

Mainstream economic theory argues that trade, and especially free trade, is beneficial to everyone involved. This fundamental idea - which has the character of a dogma - still plays an important role in international debates on trade issues, notably in relation to development and environment (Ropke, 1994). It is also suggested that trade can play a major role in achieving sustainable development (Caratti and Lo Cascio, 2006).

Progressive economic integration, initiated by trade agreements in the mid-1990s and completed by the recent enlargements in 2004 and 2007, have caused not only the strengthening of trade relations between New Member States and EU-15 countries (Lo Turco and Parteka, 2009), but also intensification of growth, increase of R&D expenditure and employment level as being some of the sustainable development ratios. The literature in the field suggests various effects of trade liberalization on growth, R&D and employment, especially at the regional level.

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The theoretical literature on trade discusses several channels through which trade can affect economic growth (Wooster, Dube and Banda, 2007). First, trade is a vehicle through which technological innovations and knowledge are transmitted between trading partners (Grossman and Helpman, 1991 and Sala-i-Martin and Barro, 1997). Second, higher trade openness also increases competition in the local market, which in turn increases production efficiency and economic growth (Vickers and Yarrow, 1991; Wacziarg, 2001). Finally, countries that can access larger markets through trade can also benefit economically. For example, Alcalá and Ciccone (2003) demonstrate that trade mattered more for growth where domestic markets were smaller suggesting that countries with small domestic markets benefit more from trade openness. Further, by increasing the size of the market, trade openness allows economies to better capture the potential benefits of increasing returns to scale (Ades and Glaeser, 1999).

The empirical literature also sought to establish a direct link between trade and growth. Thus, Wooster, Dube and Banda (2007) tested the hypothesis that regional trading blocs increase the propensity for openness of trade for their member countries and increase the sustainable development using Granger causality between trade and per capita output growth. They find that intra-regional trade Granger causes growth in 7 of the 13 countries studied. As well as, Hoeller *et al*. (1998) estimated time series and pooled regressions both in growth rates and in levels using co-integration techniques to test directly for the link between trade and growth in Europe through the technology channel. Specifically, the authors show that although trade intensities among countries within the same geographic region are greater than those between countries in different geographic regions, these intensities increase simultaneously across all time periods between 1959 and 1996.

Several authors have studied the relationship between changes in the international trade environment and employment level. Grossman (1986, 1987) and Revenga (1992) have investigated the sensitivity of sectoral employment and wages to changing import competitiveness. Both authors use import prices as indicators of the degree of import competitiveness (Hakura, 1997). Generally, in the literature on European integration issues, so far little emphasis has been put on a parallel assessment of the importance of trade intensification between EU-15 and NMS on employment structures in both groups of countries. Only Egger (2006) uses analogous data for a subsample of three CEE countries (Czech Republic, Hungary and Poland) between 1993 and 1999 and demonstrates that intermediate goods trade fostered the process of sigma wage convergence between these countries (Lo Turco and Parteka, 2009). In reality, Central Europe is already well integrated into EU-based networks (Kaminski and Ng, 2005). Thus, we can indeed expect that strong trade links existing within the EU-27 have created a net of transmission channels via trade enabling spillover effects. As a result, the authors consider that, based on mutually interdependent relations between trade and growth or labor markets in 'Old' and 'New' member states are likely to be strongly interdependent. Caporale, Rault, Christophe, Sova and Sova (2009) highlight the existence of strong asymmetries in trade relationships between the countries of the two groups. They select an appropriate specification of the gravity model and carefully investigate the main determinants of trade flows between these sets of countries.

Even after Romania and Bulgaria, two Eastern European countries, became EU members in 2007, long-term economic convergence has remained an important goal for them (Albu, 2008; Iancu, 2008). The EU enlargement, by bringing together developed and developing

economies, is generally expected to lead to higher intra-industry trade through technology transfers, and therefore to economic convergence, which is typical of regionalization (see Lundberg, 1992; Fontagné and Freudenberg, 1997, Fidrmuc and Djablík 2003). Economic integration also leads to the international diffusion of knowledge and convergence in the quality of traded goods, with a positive effect on exports (Cavallaro and Mulino, 2008). There is, in fact, a wide consensus in the literature that intra-industry trade is more conducive to economic growth than inter-industry trade, and that the former tends to take place between countries with similar factor endowments (Helpman, 1987), to stimulate innovation and to exploit economies of scale (Ruffin, 1999). Given the fact that there is a positive correlation between GDP growth and intensity of intra-industry trade, new EU members hope to achieve higher growth rates and *sustainable development,* as a result of an increase in intra-industry trade with the other members.

In the next section we estimate the impact of intra-regional trade between Romania and EU (export and imports) on sustainable development using dynamic forecasting and vector auto-regression (VAR) methods. In order to underline the relationship between the trade and sustainable development, we have chosen to study the GDP per capita and occupancy rate as being the main ratios to express the sustainable development.

1. Methodology

The framework for trade flows between the Romania and EU-15 is given by the European Agreement of 1993. Its implementation has led to a significant increase in trade volume between Romania and EU with both higher exports and imports. In Romania, the trade balance moved from a surplus to a deficit in 1992, and the latter grew over time. By 2000 (the year of starting the negotiations for Romania's accession into EU), weights for trade flows to/from the EU-15 were very close to those for intra-European trade. In the period 2000-2007, there was an increase of exports of products with higher value added, incorporating physical capital and skilled labour, but no significant changes in competitiveness such as to improve the trade balance (Caporale, Rault, Christophe, Sova and Sova, 2009).

In order to attain the objectives of the paper, we used data from Eurostat, for the years 2000-2007, the period of pre-accession to the European Union, referring to trade (imports and exports), on the one hand, and indicators of sustainable development (increase in GDP, % of GDP allocated to R&D, and occupation rate), on the other. The reason why we chose these sustainable development indicators – only three, in a simplified model – was the macro perspective, interested in the influence of trade on the evolution of GDP and on the occupation of the population in the labour force and the link between development and R&D, in the light of the Lisbon agenda, and the time horizon of 2010. The two indicators, increase in GDP and occupation rate, are included in the SDI (sustainable development indicators) proposed by the European Union (through Eurostat), and also in the national sustainable development strategies of the United Nations (http://www.un.org/esa/sustdev/natlinfo/indicators/guidelines.pdf).

We forecasted the evolution of exports, imports, increase in GDP and occupation rate, for this time horizon, and we correlated the evolution of imports and exports with the three indicators. We used dynamic forecasting, after vector auto-regression (VAR), which are multivariate time series techniques aimed at predicting the evolution of a variable over a number of periods (three, in our case). Additionally, logistic regression, categorizing

the presence or absence of a dependent variable from a certain group (for instance, the fitting of GDP value into the group *increase*, or into the group *decrease*) was used to forecast the evolution of the GDP, positive or negative, based on the evolution of exports and imports. In a binary recoding of data, a "1 value" indicated an increase, while a "0 value" indicated a decrease in GDP.

In a paper published in 1998, Krempel and Plümper have compared multivariate statistics with network visualization, in analyzing international trade. Based on the gravity model, their work shows that global economic integration is not dependent on a single factor, and unilateral explanations of it are definitely misleading. A simple model, with three variables, like the one they have used, may, on the contrary, predict fairly well the trade flows. Another conclusion of their study is that regionalization is by far a better term than globalization.

In 2007, debating the influence of intra-regional and extra-regional trade to growth, Wooster, Banda and Dube have used panel regression estimates in order to prove the greater influence of intra-regional trade to growth, as compared to extra-regional trade.

Lee (2004) studies intra-Asian trade and the perspective of an Asian-Pacific monetary unit, based on three indicators: real GDP index, the index of domestic volume of industrial production, and the unemployment rate.

Our indicators are mostly consistent with his', with the difference that we examine the positive side, of the increase in GDP, occupancy rate, and money allocated to R&D, as a source of growth. The results are shown in the next section.

2. Results and analysis

In our forecasts, performed in STATA 10, the real value of the variable fits, with a 95% probability, in the indicated interval (the gray area of the graph). The forecasts for exports and imports, respectively, based on the collected data, are shown below (figure no 1):

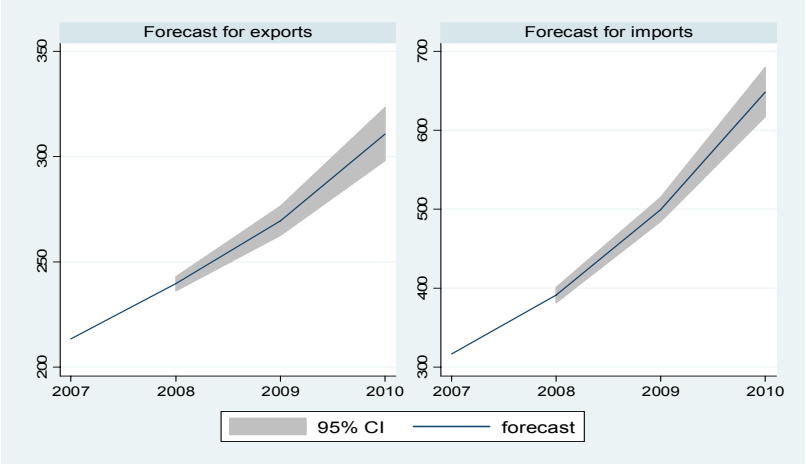

Figure no. 1: Forecasts for exports and imports (2008-2010) at 95% confidence level

Source: data processing by authors

Both trends are increasing, with the mention that the increase in imports is roughly the double of the increase in exports, which preserves the misbalance existing at the present moment, with a narrow confidence interval, accounting for the precision of the forecasts, which predict the plausible value of imports and exports within a small range of possible values. Thus, the forecast can be taken into account. In other words, the economy will still be depending on imports, in the time horizon of 2010, which affects its sustainability. This can be seen in the forecast of the increase in GDP, presented below (figure no 2):

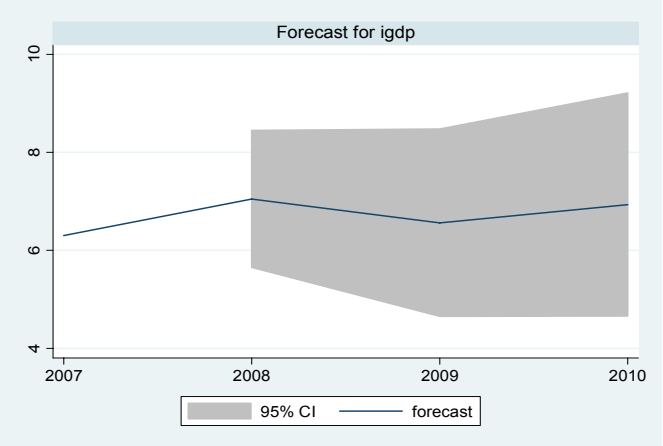

Figure no. 2: Forecast for the increase in GDP (2008-2010)

Source: data processing by authors

According to the forecast, the GDP is likely to decrease, in the following period, and then to slightly increase, by 2010. This tells that, mainly based on exports, the economy is not sustainable, and economic growth does not follow an ascending path. Increase in GDP is fairly well correlated with both imports and exports (a Pearson coefficient of 0.325, and 0.381, respectively). What leads to decreases in GDP is, then, their misbalance, the unhealthy predominance of exports over imports, which amounts to an absolute reliance on external help, and not on intrinsic growth. The evolution of the occupancy rate is shown in figure below. (figure no. 3)

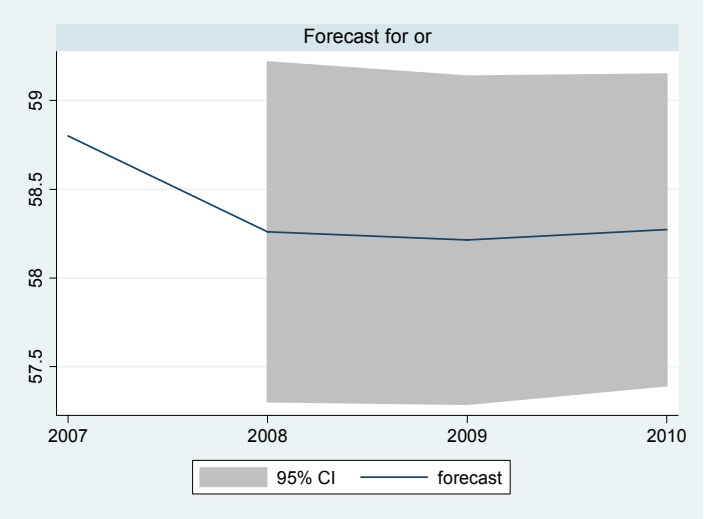

Figure no. 3: Forecast for occupancy rate (2008-2010) with a 95% confidence interval

Source: data processing by authors

The occupancy rate is on a declining trend, with a constant to slightly increasing path after 2008, which is consistent with the evolution of the GDP. An application of Okun's law for the Romanian economy, between 1992 and 2004, can be found in Turturean (2007). His conclusions point out that there is no reciprocal and unique relationship between GDP and unemployment, and that Okun's law does not work for Romania in the considered interval. If we were to quote Okun's law, for every 1% increase in unemployment, there is a 3% decrease in GDP. Our reverse perspective, of the increase in GDP and, respectively, increase in occupancy rate, proves that this law is rather numerically unreliable.

The results of the logistic regression are presented below (table no 1).

Table no. 1: Logistic regression

Logistic regression **Log likehood = -2.2105741**				**Number of obs = 8** **LR chi2(2) = 6.16** **Prob > chi2 = 0.0459** **Pseudo R2 = 0.5823**		
igdb	**Coef.**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
exports	.577665	.4409133	1.31	0.190	-.2865091	1.441839
imports	-.3496611	.2632007	-1.33	0.184	-.865525	.1662028
_cons	-22.35865	18.15675	-1.23	0.218	-57.94522	13.22793

Source: data processing by authors

The evolution of the GDP is mainly dependent on the evolution of exports (a correlation of .577), being negatively correlated with the evolution of imports (a correlation of -.349), which means that the misbalance imports-exports affects the sustainable development. The classification table for the logistic regression is presented below (table no. 2).

Table no. 2: Classification table

Logistic model for igdp		
Classified	**True**	**Total**
	D **~ D**	
+	4 1	5
-	1 2	3
Total	5 3	8
Classified + if predicted Pr(D)>=.5 **True D defined as igdp!= 0**		
Sensitivity	Pr (+| D)	80.00%
Specificity	Pr (-|~D)	66.67%
Positive predictive value	Pr (D| +)	80.00%
Negative predictive value	Pr (~D| -)	66.67%
False + rate for true ~D	Pr (+|~D)	33.33%
False - rate for true D	Pr (-| D)	20.00%
False + rate for true classified +	Pr (~D| +)	20.00%
False - rate for true classified -	Pr (D| -)	33.33%
Correctly classified		75.00%

Source: data processing by authors

The classification table shows how the model classifies: it should predict correctly the GDP increase as increases (positive cases) and the GDP decreases as decreases (negative cases). The sensitivity is the capacity to predict correctly the positive cases, which in our model is 80%; the specificity is the capacity of predicting correctly the negative cases and in our case it is of 66.67%. We can say that the model is more sensitive than specific, being at risk to predict GDP decreases as increases, so being more optimistic than in reality. Generally, the rate of correct prediction of 75% is reasonable.

Three cases out of four are correctly classified by the model, that is, an increase in GDP is predicted as an increase, and a decrease is predicted as a decrease, based on the evolution of imports and exports. Thus, the data regarding trade may be used as predictors of GDP evolution (respectively, R&D expenses) and, consequently, as predictors of economic sustainable growth.

Conclusions

Our analysis had two components: the first one being forecasting, the second, modeling dependence using logistic regression. The dynamic forecast, after vector auto-regression, estimated the trend of GDP, imports, exports, and occupancy rate, for Romania, for 2008-2010.

The logistic regression model has shown the dependency of GDP on the imports-exports balance, explaining the aspect of the trend. The increase in GDP is depending on an increase in imports, and on the equilibration of the imports-exports ratios, as to assure a sustainable development pattern, in a medium time perspective.

The analysis provides a reliable method for forecasting the dependencies between GDP increase, occupancy rate fluctuations, and the exports-imports equilibrium, being useful for policy and decision makers, in the context of regionalization and inter-regional trade.

References

Ades, A. F. & Glaeser, E L., 1999. *Evidence on Growth, Increasing Returns and the Extent of the Market.* Quarterly Journal of Economics, vol. 114(3), pp.1025- 1045.

Albu, L., 2008. *Trends in structural changes and convergence in EU.* Romanian Journal of Economic Forecasting (1), pp. 91-101.

Alcalá, F. & Ciccone, A., 2003. *Trade, Extent of the Market, and Economic Growth 1960 – 1996.* Journal of Economic Literature.

Caporale, G. M., Rault, C., Sova, R. & Sova, A., 2009. *Trade Specialisation and Economic Convergence: Evidence from Two Eastern European Countries* (April). DIW Berlin Discussion Paper No. 875. [Online] Available at SSRN: http://ssrn.com/abstract=1431447

Caratti, P. & Lo Cascio, G., 2006. *Sustainable Development Policies in Europe.* The Fondazione Eni Enrico Mattei Note di Lavoro Series Index. [Online] Available at: http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm, Social Science Research Network Electronic Paper Collection: http://ssrn.com/abstract=952936

Cavallaro, E & Mulino, M., 2008. *Vertical Innovation and Catching-Up: Implications of EU Integration for CEECs-5.* International Advances in Economic Research, (14); pp. 265-279.

Egger, P., 2006. *Intermediate goods trade and international wage convergence in Central Europe* in Lo Turco, A. & Parteka, A., 2009. *EU Enlargement, Economic Interdependence and the Labor Markets in 'Old' and 'New' Member States* (February 3). [Online] Available at SSRN: http://ssrn.com/abstract=1337078

Fidrmuc, J. & Djablík, M., 2003. *Intra-industry Trade between the EU and the CEECs. The Importance of FDI in Trade Structure,* East - West Conference.

Fontagne, L. & Freudenberg, M., 1997. *Intra-Industry Trade: Methodological Issues Reconsidered,* Working Papers CEPII Research Center; 01.

Grossman, G. & Helpman, E., 1991. *Innovation and Growth in the Global Economy*, Cambridge, MA: MIT Press.

Grossman, G. M., 1987. *The Employment Effects and Wage Effects of Import Competition.* Journal of Economic Integration, vol. 2, pp. 1-23.

Grossman, G. M., 1986. *Imports as a Cause of Injury: The Case of the U.S. Steel Industry.* Journal of International Economics, vol. 20, pp. 201-23.

Hakura, D., 1997. *The Impact of Trade Prices on Employment and Wages in the United States* (September). IMF Working Paper, Vol., pp. 1-26. [Online] Available at: http://ssrn.com/abstract=882651

Helpman, E., 1987. *Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries.* Journal of the Japanese and International Economies, vol. 1, pp. 62-81.

Hoeller, P., Girouard, N. & Colecchia, A., 1998. *The European Union's Trade Policies and their Economic Effects.* OECD Economics Department Working Papers No. 194.

Iancu, A., 2008. *Real Convergence and Integration.* Romanian Journal of Economic Forecasting, vol.1, pp. 27-40.

Krempel, L. & Plümper, T., 2003. *Exploring the Dynamics of International Trade by Combining the Comparative Advantages of Multivariate Statistics and Network Visualization.* Journal of Social Structure, vol. 4(1).

Lee, Y., 2004. *Trade, international business cycles and the optimum currency area.* [Online] Available at: http://opensiuc.lib.siu.edu/econ_dp/17/

Lo Turco, A. & Parteka, A., 2009. *EU Enlargement, Economic Interdependence and the Labor Markets in 'Old' and 'New' Member States* (February 3). [Online] Available at SSRN: http://ssrn.com/abstract=1337078

Okun, A. M., 1962. *Potential GNP and signifiance.* American Statistical Association, Proceedings of the Business and Economics section, pp. 98-102.

Revenga, A., 1992. *Exporting Jobs? The impact of International Competition on Employment and Wages.* Quarterly Journal of Economics, vol. 107, pp.255-84.

Ropke, I., 1994. *Trade, development and sustainability - a critical assessment of the "free trade dogma".* Ecological Economics , vol. 9, pp.13-22.

Sala-i-Martin, X. & Barro, R. J., 1997. *Technological Diffusion, Convergence and Growth*. Journal of Economic Growth, vol. 2(1), pp. 1 – 26.

Turturean, C.I., 2007. *Okun's law for Romania during 1992-200.* [Online] Available at: mpra.ub.uni-muenchen.de/10638/1/MPRA_paper_10638.pdf

Vickers, J. & Yarrow, G., 1991. *Economic Perspectives on Privatization.* Journal of Economic Perspectives, vol. 1991(5), pp. 111-32.

Wacziarg, R., 2001. *Measuring the Dynamic Gains from Trade.* The World Bank Economic Review, vol. 15(3), pp. 393-429.

Wooster, R. B., Dube, S. & Banda, T. M., 2007. *The Contribution of Intra-Regional and Extra-Regional Trade to Growth: Evidence from the European Union* (January 16). [Online] Available at SSRN: http://ssrn.com/abstract=957715